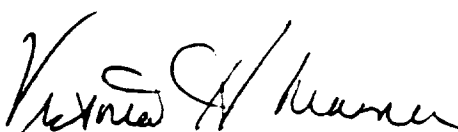


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**REVIEW AND COMMENTS ON THE USEPA
PROPOSED GROUNDWATER REMEDY FOR THE
NL INDUSTRIES/TARACORP SUPERFUND SITE,
GRANITE CITY, ILLINOIS**

April 17, 1995

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**REVIEW AND COMMENTS ON THE USEPA
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E.0 EXECUTIVE SUMMARY

On behalf of the Potentially Responsible Party (PRP) Committee for the NL Industries/Taracorp Site, Geraghty & Miller, Inc. has prepared this comment document regarding the United States Environmental Protection Agency (USEPA) proposed groundwater remedy for the NL Industries/Taracorp superfund site, Granite City, Illinois (the site). The proposed groundwater remedy, which consists of groundwater containment and long-term monitoring, is described in the Second Addendum to the Feasibility Study (FS) (Woodward-Clyde Consultants [WWC] 1995) and is summarized in the Proposed Plan published by the USEPA in February 1995 (USEPA, 1995). Our comments are based on a review of the relevant literature on the subject of sampling for metals in groundwater, the groundwater remedy itself, the groundwater data on which the remedy is based, and a reinterpretation of the data. This document concludes that USEPA's proposed groundwater remedy is unnecessary and inconsistent with the National Contingency Plan (NCP).

E.1 LITERATURE REVIEW

Our literature review indicates that there is no consensus in the industry as to how to collect groundwater samples for the analysis of metals. The USEPA's position has been inconsistent, and the Agency's current guidance requires the collection of both filtered and unfiltered samples. Several states have published guidance or have adopted policies regarding filtering of samples but there is no general agreement among the states' procedures and policies.

Even though there appears to be little agreement on the actual sampling technique, a consensus has developed that the turbidity of samples should be minimized at the time of collection.

For this reason, an alternative method of sampling has been developed. The so called "low flow" sampling techniques involve pumping wells at a low flow rate which minimizes the well disturbance and keeps turbidity low. However, if turbidity cannot be kept low, filtering groundwater samples is preferable.

E.2 REGIONAL HYDROGEOLOGY

Groundwater in the Granite City area occurs in valley fill deposits under water table or leaky artesian conditions. Generally, groundwater flow is from northeast to southwest towards the Mississippi River. The Illinois Water Survey indicates (Collins & Richards 1986) that groundwater usage in the Granite City area is for industrial purposes. The local water utility district which serves Granite City and the adjacent communities of Madison and North Venice, indicates that they use treated water from the Mississippi River; no groundwater is used for potable purposes.

E.3 PROPOSED GROUNDWATER REMEDY

The proposed remedy, which was based on the analytical results of unfiltered groundwater samples collected by WWC, consists of an active pumping system in the Main Industrial Property and monitoring and natural attenuation in the Remote Fill Areas. The water from the recovery wells would be treated, if necessary, before discharge to the Publicly Owned Treatment Works (POTW). The proposed remedy does not specify the number of extraction wells or the pumping rates needed to contain groundwater in the Main Industrial Property.

E.4 COMMENTS ON THE PROPOSED REMEDY

The proposed groundwater remedy is based on groundwater quality data which are not reproducible and therefore difficult to interpret. The remedy was selected because the concentrations of metals in unfiltered turbid samples were reported to exceed applicable, relevant and appropriate requirements (ARARs) which are maximum contaminant levels (MCLs) and the

Illinois groundwater quality standards (IGQS). However, when the data are reinterpreted using the population of filtered samples combined with samples collected with the "low flow" technique, the average concentrations of all metals are below MCLs, except for cadmium, and are below their IGQS, except for cadmium and lead. However, the average concentrations of cadmium and lead exceeded the MCLs and IGQSs only because high concentrations in a few wells skewed the averages higher. When these wells are excluded, the average cadmium concentrations are below the MCLs and IGQSs, and the average lead concentrations are below the MCLs and are only 1.3 times the IGQSs.

Because the groundwater appears to meet most ARARs, and there is no risk to human health from exposure to groundwater (which USEPA acknowledged and appears to agree with), there is no reason to remediate the groundwater. Exposure to groundwater is not a pathway because potable water is supplied by a local utility from the Mississippi River and there appears to be little possibility that the groundwater resources of the area would be developed for a potable supply in the future.

In addition, USEPA's proposed groundwater pumping remedy would not be effective. The elevated metals concentrations in the samples collected by USEPA were due to high turbidity in the samples. In other words, the metals concentrations in the samples were caused by metals in the sediments, not by metals in the groundwater. When groundwater recovery wells are installed as part of a groundwater pumping system, they must be designed to minimize the sediments in the extracted groundwater to avoid damage to pumps and other equipment. Thus, the extracted groundwater would at most contain very low levels of metals while the vast majority of the metals would remain tied to the sediments and would be immobile and unrecoverable.

Finally, even if groundwater at the site did contain elevated concentrations of metals, which does not appear to be the case, a groundwater remedy based on capping the source area to reduce infiltration, natural attenuation and monitoring would effectively reduce metals concentrations over time. Indeed, capping the pile at the Main Industrial Area is already a component of the proposed

remedy. In addition to being cost effective, natural attenuation would be protective of human health and the environment because there is no exposure pathway and therefore no risk associated with the groundwater.



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1.0 INTRODUCTION

On behalf of the Potentially Responsible Party (PRP) Committee for the NL Industries/Taracorp Site, Geraghty & Miller, Inc. has prepared this comment document regarding the United States Environmental Protection Agency (USEPA) proposed groundwater remedy for the NL Industries/Taracorp superfund site, Granite City, Illinois (the site). The proposed groundwater remedy, which consists of groundwater containment and long-term monitoring, is described in the Second Addendum to the Feasibility Study (FS) (Woodward-Clyde Consultants [WWC] 1995) and is summarized in the Proposed Plan published by the USEPA in February 1995 (USEPA 1995a).

The site is located almost entirely within the cities of Granite City, Madison, and Venice, in Madison County, Illinois, approximately 2 miles east of downtown St. Louis, Missouri. The site has been divided into three principal areas: the Main Industrial Property, the Adjacent Residential Areas (within the cities of Granite City, Madison, and Venice), and the Remote Fill Areas. The Main Industrial Property is approximately 30 acres in size; the Adjacent Residential Areas consist of approximately 500 acres; and the Remote Fill Areas include locations in Eagle Park Acres and Venice Township (WWC 1995). The proposed groundwater containment remedy selected for the site addresses the Main Industrial Property; monitoring and natural attenuation is proposed for the Remote Fill Areas.

Geraghty & Miller believes that the proposed groundwater remedy selected for the site is inappropriate for the following reasons: (1) the remedy is based on groundwater quality data that are not reproducible and therefore difficult to interpret; (2) the selection of the remedy does not comply with the National Contingency Plan (NCP); (3) the remedy is not warranted because no risk is associated with the groundwater, and our re-evaluation of the data indicates that the average metals



concentrations are below most MCLs and IGQSs; and (4) groundwater pumping would not be effective since the metals are contained in the sediments, not the groundwater, and therefore would not be removed by pumping. Even if elevated levels of metals did exist in the groundwater at the site, Geraghty & Miller believes that a remedy consisting of capping, natural attenuation, and monitoring would be equally protective of human health and the environment and more cost-effective.

Geraghty & Miller's comments are based on a review of the literature concerning sampling for metals in groundwater, the groundwater remedy, the groundwater data on which the remedy is based, and on a reinterpretation of the data.

1.1 LITERATURE REVIEW

Geraghty & Miller has reviewed the pertinent literature regarding groundwater sampling techniques for metals analysis. Our evaluation indicates that there is no consensus in the industry as to the correct groundwater sampling technique. There is agreement that turbidity of groundwater samples must be minimized, which can be done with 'low flow' sampling techniques or filtering turbid samples.

The primary objective of any sampling program is to collect samples that are representative of the site. Many scientists believe that the collection of filtered samples for metals analysis is preferable because the analysis of unfiltered samples has the potential to provide "false-positive" results. Unfiltered metal groundwater results might be more related to how the well was drilled, developed, and sampled rather than to the actual groundwater metal concentrations. The USEPA emphasizes the importance of developing wells to be sediment-free and specifies that hydraulic conductivity, pH, and temperature measurements, along with mean seasonal flow rates, be used to determine when periodic redevelopment of wells is required (USEPA 1986).

Several studies have shown that the use of bailers to purge and/or collect groundwater samples has increased the turbidity of the samples (Backhus et al. 1993, Heidlauf and Bartlett 1993, Kearn et al.

1992, Puls and Barcelona 1989, Puls et al. 1991, and Puls et al., 1992). These studies recommend the use of low pumping flow rates (approximately 100 milliliters per minute [ml/min]) to collect non-turbid samples. Puls et al. (1991) concluded that there was a strong inverse relationship between the turbidity and the representiveness of samples, and Puls et al. (1992) found that the sampling devices that caused the least disturbance (i.e., turbidity) also produced the most reproducible samples. Heidlauf and Bartlett (1993) concluded that the concentration of insoluble metals in test samples was turbidity-dependent; they also found that when low-flow pumps to purge and sample the wells were used, representative non-turbid groundwater samples were obtained.

The study by Puls et al. (1992) found that monitoring field parameters during well purging provided the best indication of when to begin collecting a groundwater metals sample. Turbidity was found to be the most sensitive indicator when monitored during well purging. Other field parameters measured by Puls et al. (1992) were dissolved oxygen, pH, redox, temperature, and specific conductance. Temperature, specific conductance, and pH results were found to be generally insensitive to well purging variations.

If only unfiltered metal samples are collected, increased importance is placed on proper well construction, purging procedures, and sampling procedures to eliminate or minimize sources of sampling artifacts (Puls and Barcelona 1989). Therefore, Puls and Barcelona (1989) recommended the collection of both unfiltered and filtered samples.

Many government agencies agree that the collection of unfiltered groundwater samples alone for metals is insufficient to obtain representative results. In 1992, the State of Wisconsin prepared a document, entitled "Position Paper on the Field Filtering of Groundwater Samples," (Wisconsin Department of Natural Resources [WDNR] 1992) to express its concerns over using unfiltered groundwater samples. This document, which was sent to the USEPA, provides a strong argument for allowing flexibility "to determine whether filtered or unfiltered samples are appropriate depending on a given situation." The following conclusion was provided in the summary of the State of Wisconsin's document (WDNR 1992):

"The technical experts we contacted made it clear to us that there is not agreement in the monitoring community to not allow field filtration of ground water samples. In fact, most of the experts feel field filtration is appropriate especially if the sample is turbid. They also think total analysis of turbid samples will produce misleading results. Those with experience in the field know that turbid samples will continue to be collected from monitoring wells, especially those in fine-grained soils. Those that favor running total analyses think monitoring wells can be installed, developed and sampled in such a manner that the sample is relatively free of turbidity. We consider this presumption to be unrealistic."

The USEPA's notice of proposed rulemaking on the field filtering of groundwater samples related to the RCRA Subtitle D Solid Waste Disposal Facility Criteria was published in the October 25, 1993 Federal Register (USEPA 1993). The following is an excerpt from this notice:

"The Criteria ban the filtering of groundwater samples in the field because filtering potentially removes some of the contamination found in the solid phase of the samples. Since promulgation of the Criteria, a number of States and industry groups have stated that it is important to field filter groundwater samples for metals to avoid potential false indications of a landfill release to groundwater. The commentators maintain that the analytical results using filtered samples are sufficiently protective and are as effective as unfiltered samples required in the Criteria. This notice of proposed rulemaking (NPRM) would announce the Agency's intent to perform additional study on field filtering and solicit further public comment and data on this issue. In addition, this NPRM would seek comment on the appropriateness of allowing States/Tribes with EPA-approved permit programs to lift the ban on a site-specific basis."

The sampling and analysis criteria in the State of Illinois do not specify whether filtered and/or unfiltered metal samples results are acceptable. Indeed, the Illinois Pollution Control Board is considering this issue in the context of the pending underground storage tank rulemaking. Several

other states do not have a written policy. However, some states do provide guidance for collecting filtered groundwater samples. New York, for example, requires that the samples be filtered in the field if the turbidity of the groundwater exceeds 50 nephelometric turbidity units (NTUs). In addition, the New Jersey Department of Environmental Protection and Energy (NJDEPE) Field Sampling Procedures Manual (NJDEPE 1992) states that "If a particular case demands consideration of dissolved metals, both filtered and non-filtered samples should be collected for analysis." The Florida Department of Environmental Regulation (FDER) recently prepared a technical document to provide an assessment procedure for determining when filtered samples for metals compliance monitoring can be used (FDER 1994). West Virginia also accepts field filtering of groundwater samples for metals analysis under certain conditions in its promulgated legislative rule (WVSWRB 1992), which became effective on August 25, 1993.

1.2 REGIONAL HYDROGEOLOGY

The Granite City area is situated within a bedrock valley cut by the Mississippi River (Bergstrom and Walker 1956). The preglacial bedrock valley has been filled with Recent Alluvium and glacially derived valley-train materials (collectively referred to as the valley fill). The valley fill in the Granite City area varies between approximately 80 and 120 feet thick, with the materials thinning to the west towards Chain of Rocks Canal. The river channel at Chain of Rocks, which is west of the Chain of Rocks Canal, is reported to intersect bedrock (Bergstrom and Walker 1956).

The valley fill includes silts and clays at or near the surface deposited during recession of floodwaters. As is evidenced by Horseshoe Lake, an oxbow type lake, immediately to the east of Granite City, the Mississippi River has migrated over time across the broad bottom lands, which are 6 to 8 miles wide in the Granite City area. The channel migration, the associated cut-and-fill actions, and the flooding have produced complex hydrogenous deposits of varying thicknesses.

Investigations conducted by the Illinois State Water Survey (Piskin and Bergstrom 1975) indicate that the sand and sand and gravel deposits below the surficial silts and clays, become coarser

with depth. At the base of the valley fill deposits in the Granite City area, 20 to 35 feet of clean sand and gravel are encountered (Bergstrom and Walker 1956). These deposits become finer to the east and grade into dominantly sand and silt in the Horseshoe Lake area.

Groundwater in the Granite City area occurs in valley fill deposits under water table or leaky artisan conditions, depending upon the extent to which fine- and coarse-grained sediments are interbedded. Locally, portions of the surficial silts and clay may be saturated and would therefore be under water-table conditions. Bedrock while saturated, is generally not considered a significant source of groundwater in the bottomlands area. The bedrock is generally of lower permeability with water being yielded primarily from fractures.

Generally groundwater flow in the valley fill deposits is from northeast to southwest in the Granite City area. Locally, groundwater pumping and the associated cone of depression, will change the regional groundwater flow pattern. From 1978 to 1980, groundwater level monitoring performed by the Illinois State Water Survey (Collins and Richards 1986) identified a water-table depression on the west side of Granite City, which appears to be associated with a pumping center.

Groundwater under non-pumping conditions is recharged by rainfall and floods. The Mississippi River is a major groundwater discharge area under normal river stage conditions. Under high flow conditions when the river level is higher than the water table, the Mississippi River will serve as a recharge source for the valley fill aquifer. In situations where high volume pumping is occurring near the river, flow will be from the river toward the pumping center.

The Illinois Water Survey indicates that groundwater usage in the Granite City area is for industrial purposes and that fluctuations in groundwater usage were related to the cyclical nature of the area's steel industry (Collins and Richards 1986). The local water utility district, which serves Granite City and the adjacent communities of Madison and North Venice, indicates that it uses treated Mississippi River water in the area's distribution systems.

2.0 PROPOSED GROUNDWATER REMEDY

The selection of the proposed groundwater remedy for the site was based on the analytical results of groundwater samples collected by O'Brien & Gere during the RI/FS (O'Brien & Gere, Engineers, Inc. 1988) and WWC during the PDFI (WWC 1995). The proposed remedy consists of groundwater containment on the Main Industrial Property and monitoring and natural attenuation in the Remote Fill Areas. The active system would be designed to contain groundwater on the Main Industrial Property by installing a series of on-site extraction wells, which would be pumped at a rate sufficient to control off-site groundwater flow. The water produced from the extraction wells would be pre-treated on-site, if necessary, and would be discharged to the local Publicly Owned Treatment Works (POTW). Because the extent of groundwater impacted with lead and other metals has not been defined, additional monitoring wells would be required to identify the extent of groundwater contamination. The wells would be located downgradient of the existing monitoring wells where "high" levels of lead or cadmium have supposedly been detected. The groundwater action for the Remote Fill Areas would consist of long-term monitoring, usage restriction, and natural attenuation. Additional monitoring wells would also be required for the Remote Fill Areas to determine if groundwater in those areas have been impacted because no monitoring wells are currently located in these areas.

The proposed remedy does not specify the number of extraction wells or the pumping rates needed to create a capture zone capable of containing groundwater on-site, nor does it specify the number and or location of additional monitoring wells needed to define the extent of groundwater impacted with lead or other metals.

3.0 COMMENTS ON THE PROPOSED GROUNDWATER REMEDY

Geraghty & Miller's comments on the proposed groundwater remedy are based on the fact that the remedy selected is predicated on nonreproducible groundwater quality data that are difficult to interpret. The selection of this remedy is not consistent with the NCP because the USEPA ignored previously collected data, and only used the most conservative groundwater data results on which to base its remedy selection. This approach has resulted in a remedy that is not cost-effective. In addition, the results of a well survey conducted by O'Brien & Gere and the Illinois Environmental Protection Agency (IEPA) indicate that there is no need to implement a groundwater remedy because there are no receptors (and therefore no risk) associated with the groundwater. Finally, the remedy selected is inappropriate because it will not remediate metals in the groundwater. Each of these comments is discussed in detail in the following sections.

3.1 THE PROPOSED GROUNDWATER REMEDY IS BASED ON GROUNDWATER QUALITY DATA THAT ARE NOT REPRODUCIBLE AND ARE DIFFICULT TO INTERPRET

The proposed groundwater remedy for the site was based on the Pre-Design Field Investigation (PDFI) that was conducted by WWC in 1993, on behalf of the USEPA. The remedy was selected because WWC concluded that the concentrations of lead and other metals reported in the groundwater samples exceed the USEPA maximum contaminant level (MCL) of 0.015 milligrams per liter (mg/L) for lead and the Illinois Groundwater Quality Standard (IGQS) of 0.0075 mg/L for lead. The conclusions in the PDFI regarding impacts to groundwater were based on total metals analyses, which are the most conservative data set (WWC 1993).

As discussed below in Sections 3.1.1, 3.1.2, and 3.1.3, most of the monitoring wells installed appear to have been insufficiently developed. Because of the less than optimal development procedures, the groundwater samples collected from these monitoring wells were generally turbid. The increased turbidity of the groundwater samples interferes with the metals analyses, and consequently analytical results are not reproducible from one sampling event to the next. In addition, analyzing

turbid, unfiltered groundwater samples for metals analyses leads to an overestimate of the metals concentrations because the acidification process leaches metals that would otherwise remain on the sediment, which is not mobile in the groundwater system.

The sampling techniques utilized to collect groundwater samples were not consistent between sampling events. Some monitoring wells were purged and sampled with a bailer; some wells were purged with a submersible pump and sampled with a bailer; some wells were purged and sampled with a submersible pump; and some samples were collected for filtered and unfiltered metals analyses. The variability in the sampling methods used has contributed to the difficulty in interpreting the data. Because of the variations in sampling techniques, there is a significant difference between analytical results of filtered versus unfiltered samples, and samples collected with a bailer versus a low flow submersible pump. When filtered and unfiltered samples provide significantly different results, it is difficult to determine whether unfiltered data reflect the presence of mobile colloids or sampling artifacts related to the sampling process. Sampling artifacts may include the following: pump velocity, sample oxidation, well construction materials, and/or filter size (Wendell et al. 1992, USEPA 1989). Additionally, several studies have shown that significant differences in concentrations from one sampling event to the next are invariably due to the manner in which samples are collected rather than from contributions due to the transport of colloidal material (Puls et al 1992).

Summarized below are the previous investigations conducted at the site by the IEPA, O'Brien & Gere, and WWC. The following summaries focus on well development, groundwater monitoring techniques, and the analytical results.

3.1.1 Investigations Conducted by the IEPA

In 1981 and 1982, the IEPA conducted an investigation into the impacts to groundwater in the Granite City area from the 3-acre storage pile located within the city boundaries. The results of this investigation are summarized in a report entitled "A Land Pollution Assessment of Granite City/Taracorp Industries" (IEPA 1984) and are discussed below.

In October 1982, four monitoring wells (MW-101, MW-102, MW-103, and MW-104) were installed by Taracorp at the request of the IEPA. Table 1-1 summarizes the construction details for these monitoring wells; however, specific details regarding well development, and groundwater sampling techniques were not included in the reports reviewed by Geraghty & Miller. The analytical results of groundwater samples collected from these wells in November 1982 indicated that the downgradient well (MW-104) contained an elevated concentration of lead (0.05 parts per million [ppm]). However, the IEPA later questioned the integrity of these samples and actually discarded the results as invalid because the samples were not filtered in the field (IEPA 1984). Based on these data, the IEPA determined that additional soil and groundwater sampling should be conducted (IEPA 1984).

In July 1983, the IEPA installed eight monitoring wells (MW-105S, MW-105D, MW-106S, MW-106D, MW-107S, MW-107D, MW-108S, and MW-108D). These wells comprise a two-well cluster with "S" denoting a shallow well installed at the water table and "D" denoting a deep well installed 10 to 15 ft deeper than the shallow well. Table 1-1 summarizes well construction details for these wells. Specific details regarding well development were not included in the reports reviewed by Geraghty & Miller. The groundwater sampling logs from each of these sampling events specify that all samples were filtered in the field prior to preservation, and that field parameters for pH, specific conductance, and temperature were measured. During these monitoring activities, filtering of groundwater samples prior to preservation and laboratory analyses was accepted and considered a state-of-the-art technique.

Groundwater samples were collected by the IEPA from Monitoring Wells MW-101, MW-102, MW-103, and MW-104 in January, February, June, August, and November 1983 and from Monitoring Wells MW-105S, MW-105D, MW-106S, MW-106D, MW-107S, MW-107D, MW-108S, and MW-108D in August and November 1983. The results of the sampling and analysis program indicated that the concentrations of lead in each of the monitoring wells sampled were below the Illinois General Use Water Quality Standard (35 Ill. Adm. Code 302.208) of 0.1 ppm.

Based on the data collected by IEPA in 1982 and 1983, impacts to groundwater quality were not an issue of concern for the site. In addition, the concentrations of lead detected in the groundwater samples collected were below the MCL of 0.050 mg/L, which was in effect from 1975 through June 1991.

3.1.2 Investigations Conducted by O'Brien & Gere Engineers, Inc.

O'Brien & Gere conducted a Remedial Investigation/Feasibility Study (RI/FS) at the site between 1986 and 1987 on behalf of NL Industries. As part of this investigation, two monitoring wells (MW-109, and MW-110) were installed in July 1987. Table 3-1 summarizes the construction details for these monitoring wells; however, the specific well development techniques utilized by O'Brien & Gere were not included in the RI/FS Report (O'Brien & Gere Engineers, Inc. 1988). The RI/FS Report refers to the RI/FS Work Plan Addendum (O'Brien & Gere 1987), which specifies the well development techniques to be utilized during the RI field investigation.

The monitoring well development procedures summarized in Appendix D of the RI/FS Work Plan Addendum, identify three well development techniques that may be used to develop Monitoring Wells MW-109 and MW-110. The procedure specifies that "air surging, pumping, or bailing groundwater from the well would be conducted for a minimum of 2 hours until relatively sediment-free water was produced. The actual development technique used would depend on the size and depth of the well, and the volume of groundwater in the well" (O'Brien & Gere 1987). Although the development methods specified by O'Brien & Gere are generally acceptable methods, it does not appear that the development techniques were effective at adequately developing these monitoring wells because groundwater samples collected from these wells were consistently very turbid.

In January, April, August, and November 1987, O'Brien and Gere collected groundwater samples from monitoring wells at the site. Table 3-2 provides a summary of the wells sampled including the sampling data and whether filtered and/or unfiltered water samples were collected. The

field sampling protocols specified in the RI/FS Report reference Appendix D of O'Brien & Gere's RI/FS Work Plan (O'Brien & Gere 1986).

The well purging and sampling techniques specified by O'Brien & Gere in Appendix D of the RI/FS Work Plan included a procedure that required sampling personnel to "Lower the bailer to the bottom of the well, and agitate the bailer up and down to re-suspend any material settled in the well." (O'Brien & Gere 1986). Because no other documentation is provided in the RI/FS Report (O'Brien & Gere 1988), Geraghty & Miller has assumed that O'Brien & Gere followed this sampling protocol. Repeated insertion and withdrawal of a bailer causes significant surging, mixing, and aeration, even when the procedure is carefully performed. Results obtained with a bailer are operator-dependent and therefore quite variable (Puls et al. 1992).

During each of the four groundwater sampling events conducted by O'Brien & Gere in 1987, groundwater samples were consistently filtered in the field prior to sample preservation for metals analysis. In addition, groundwater samples collected from five of the monitoring wells (MW-102, MW-106D, MW-108S, MW-108D, and MW-110) were also analyzed for total lead. The results of these sampling events are summarized in Table 3-3.

3.1.3 Investigations Conducted by Woodward-Clyde Consultants

After completion of the RI/FS by O'Brien & Gere, WWC conducted the PDFI between November 1991 and June 1992 (WWC 1993). The objective of the PDFI was to collect the data necessary to implement a remedial action for the site. As part of the PDFI, four monitoring wells (MW-103-91, MW-104-92, MW-109-92, and MW-111-92) were installed to depths of 69 to 72 ft below grade to evaluate impacts to deeper groundwater zones at the site. Table 1-1 summarizes the construction details for these wells.

The monitoring well development technique employed by WWC involved alternately surging and pumping the well until the development water and turbidity were reduced to acceptable levels

(WWC 1993). After the pH, temperature, and conductivity had stabilized, well development was completed using the pump, and was then continued by removing the last five well volumes using a stainless-steel bailer. In all instances, once the pH, temperature, and conductivity readings stabilized, and turbidity had been reduced to an acceptable level, the development water was very clear. However, while the last five well volumes were being removed with a bailer, the development water would become very turbid. Significantly, even though the development process did not result in a well that produced clear water, WWC, in consultation with the United States Army Corp of Engineers (USACE) "decided that due to the well graded sand within the screened interval and limitation on the pumping rate in the small well diameter, complete well development within a reasonable time frame was not feasible, and development was discontinued" (WWC 1993).

A review of the well development logs provided in Appendix D of the PDFI report (WWC 1993) makes clear that the well had been continuously pumped during the development procedure and not surged. WWC stated in the PDFI report (WWC 1993) that the intake hose of the pump was moved up and down across the screened interval. This activity appears to constitute the surging WWC referred to in the PDFI report. This method is considered to be an inadequate development method (Driscoll 1986).

As part of the PDFI, WWC conducted groundwater sampling in July 1992. Since completion of the PDFI, WWC has conducted routine groundwater monitoring in October 1992, March 1993, September 1993, April 1994, July 1994, and October 1994. The sampling protocols followed by WWC for sampling events conducted in July and October 1992 included the following protocols:

- Purging all shallow wells a minimum of five well volumes with a polyvinyl chloride (PVC) bailer, and then using a stainless-steel bailer to collect groundwater samples for laboratory analyses.
- Purging all deep wells installed by WWC (MW-103-91, MW-104-92, MW-109-92, and MW-111-92) with a submersible pump and then sampling with a stainless-steel bailer.

- Filling sample jars for laboratory analyses.
- Filling a separate jar to measure field parameters of pH, conductivity, temperature, and water clarity.

The sampling protocols followed by WWC for sampling events conducted in March and September 1993 included the following protocols:

- Purging Wells MW-107S and MW-107D (in March 1993) and Wells MW-101, MW-107S, and MW-108S (in September 1993), a minimum of five well volumes with a PVC bailer, and then using a stainless-steel bailer to collect groundwater samples for laboratory analyses.
- Purging all other wells sampled a minimum of five well volumes with a submersible pump, and then collecting groundwater samples for metals analyses directly from the pump discharge at a rate of 500 ml/min, or at the lowest flow rate the pump could sustain.
- Filling a separate jar to measure field parameters of pH, conductivity, temperature, and water clarity.

The sampling protocols followed by WWC for the sampling event conducted in April 1994 included the following protocols:

- Purging Wells MW-105S, MW-106S, and MW-108S, a minimum of five well volumes with a PVC bailer, and then using a stainless-steel bailer to collect groundwater samples for laboratory analyses.
- Purging all other wells sampled a minimum of five well volumes with a submersible pump, and then collecting groundwater samples for metals analyses directly from the pump discharge at a rate of 1 liter per minute (L/min), or at the lowest flow rate the pump could sustain.

- Filling a separate jar to measure field parameters of pH, conductivity, temperature, and water clarity.
- Filtering samples from those monitoring wells where the concentrations of total lead and other metals had previously exceeded a regulatory standard through a 0.45-micron filter in the field prior to sample preservation.

The specific sampling protocols followed by WWC for the sampling events conducted in July and October 1994 were not available for G raghty & Miller to review. However, based on the data summarized in Table 5 of the Second FS Addendum (WWC 1995), a sampling technique similar to the April 1994 sampling event appears to have been followed, because samples were collected for both filtered and unfiltered metals analyses.

These sampling protocols are consistent with the current state-of-the-art recommended field sampling protocols (Kerr 1992). Several studies have suggested that sample collection methods have the greatest impact on sample quality, accuracy, and reproducibility. Groundwater samples collected by WWC between July 1992 and October 1994 are summarized in Appendix A.

These data indicate a downward trend in total lead concentrations between July 1992 and April 1994. This trend may be attributable to the fact that routine purging of these wells during the sampling events may actually result in the continual development of the wells. As the wells are developed, the turbidity of the wells decreases, and consequently the concentrations of total lead decrease. In addition, the data collected from the April, July, and October 1994 sampling events are consistent with the data previously collected by O'Brien & Gere in that the concentrations of dissolved metals are consistently less than the concentrations of total metals. It should also be noted that the total metal concentrations in the wells purged and sampled using a submersible pump were more than an order of magnitude lower than those wells purged and sampled using a bailer. This difference is evident when the analytical results of Wells MW-104, MW-106D, MW-107D, MW-108D, MW-109, and MW-110 are reviewed; these results are summarized in Appendix A. The variability of the total metals results is directly related to the turbidity of the samples; however, since turbidity measurements were not

recorded at the time any of these samples were collected, a direct comparison between total metal concentrations and turbidity cannot be made.

3.1.4 Reinterpretation of Data Collected Subsequent to Previous Investigations

Geraghty & Miller's review of the well installation and development protocols indicates that the monitoring wells were insufficiently developed when they were installed. The evaluation of the data shows that as time went on, the groundwater samples became less and less turbid as they were collected. With each sample set, the wells were pumped and/or bailed for a certain period of time to remove stagnant water; this pumping/bailing progressively improved the ability of each well to produce water that was increasingly sediment-free. The improvement in yield and the reduction in turbidity with each sampling event is a sign of poor original well development.

Aside from the poor original well development, the problems with the data at this site reflect, to a large extent, changes in state-of-the-art sampling techniques and changes in the way metals data have been interpreted. In the middle 1980s, when the IEPA conducted groundwater monitoring and O'Brien & Gere conducted its RI/FS, the accepted protocol for sampling metals was to filter the samples in the field then to acidify them. Later on, many regulatory agencies became concerned that field filtering samples for metals analysis actually removed some of the metals fraction that was thought to be mobile and that filtering would lead to an underestimate of the mobile metals fraction.

As noted in Section 1.1, many experts in the industry argued that analyzing unfiltered samples would lead to an overestimate of the metals concentration because the acidification process would leach metals from sediment that would otherwise remain immobile in the groundwater system. They also argued that the reproducibility of the data would decline, which is exactly what appears to have happened at the Granite City Site. Indeed, the WWC data indicate that the metals concentrations appear to be correlated to the turbidity concentration in the sample and that the data are not reproducible from one sampling event to another.

The nonreproducibility problems with sediment in groundwater samples became apparent at many sites and has recently led to an alternate protocol that involves pumping the well at a very low rate so as to minimize the mobilization of sediment in the well. Experience with the new 'low flow' sampling protocols indicates that the data are reproducible and appear to approximate concentrations that are determined with filtered samples. In fact, the most recent samples collected with this technique from the Granite City Site appear to support the recent experiences at other sites.

Geraghty & Miller concurs with the literature that turbidity in samples to be analyzed for metals must be minimized; otherwise the concentrations of mobile metals will be overestimated. At the same time, the consensus in the industry is that it is unrealistic to expect that monitoring wells can be constructed cost-effectively to exclude all turbidity (especially in fine-grained materials), which means that sediment in groundwater samples must be addressed at the time of sampling. Low flow sampling techniques appear to be one good way to minimize turbidity, but if the samples are extremely turbid, they should be filtered and analyses should be run on both the filtered and unfiltered samples. The latter procedure is included in the USEPA's field sampling protocols.

To make sense of the data collected from the site, Geraghty & Miller reinterpreted them by assuming that only data from filtered samples and from samples collected with low flow methods truly represent site conditions. Only the extremely turbid samples which were collected by O'Brien & Gere and WWC with a bailer and not filtered, were excluded. Table 3-4 compares the average metals concentrations for the five metals identified by WWC as exceeding ARARs. All analytical results in all the filtered samples are below MCLs and the IGQS, except for the average concentration of cadmium (0.04433 mg/L) which exceeds its MCL and IGQS of 0.005 mg/L. In the set of samples collected with the low flow technique but unfiltered, only the concentrations of cadmium and lead (0.586 mg/L and 0.0237 mg/L, respectively) exceed their respective MCLs of 0.005 mg/L and 0.015 mg/L and their IGQS of 0.005 mg/L and 0.0075 mg/L, respectively. If all the low flow and filtered samples are included together, only the average for cadmium (0.06362 mg/L) exceeds its MCL and IGQS and the average for lead (0.0191 mg/L) only slightly exceeds the MCL and exceeds its IGQS by a factor of about 2.

Even though the average concentrations for cadmium and lead exceed the standard, an examination of the data for individual wells indicates that a very few samples are responsible for the high averages. For example, the very high cadmium concentrations in Well 108D skew the average concentrations for this metal. If Well 108D is excluded, all the averages for cadmium fall below its MCL and IGQS. With respect to lead, if the data from Wells MW104-92, MW107S, and MW102 are excluded, the average concentrations fall below the MCL and are only 1.3 times the IGQS.

Geraghty & Miller's reinterpretation of the data indicates that groundwater remediation is not required based on exceedences of standards. Average concentrations of metals in the combined samples, which includes filtered and low flow analyses, generally fall below or only slightly exceed standards. If data from a few wells with high metals concentrations are excluded, then all ARARs are met. Remediation of the groundwater is not warranted when the vast majority of the groundwater wells at the site are in compliance with standards and there is no completed exposure pathway.

3.2 THE PROPOSED GROUNDWATER REMEDY SELECTED IS NOT IN COMPLIANCE WITH THE NATIONAL CONTINGENCY PLAN

USEPA did not follow the steps required by the NCP to determine if remediation of groundwater is necessary at the site. Specifically, requirements associated with properly collecting and analyzing the necessary data to adequately characterize the site for the purposes of developing and evaluating effective remedial actions have not been met. The data used by USEPA to evaluate the remedial alternatives did not take into consideration the entire database associated with the site. Therefore, USEPA's decision regarding the need for the cost of the groundwater remediation was improperly made. A brief discussion of this issue is provided below:

- The NCP requires that the necessary data be collected to assess the extent to which the release poses a threat to human health and the environment (40 CFR 300.430[d][2]). As noted above, this was not done.

- As specified by the NCP, data collected subsequent to previous investigations conducted at the site must be used to develop a conceptual understanding of the site (40 CFR 300.430[b][1] and [2]). The filtered metals results previously collected by IEPA and O'Brien & Gere were not used by USEPA when evaluating the proposed remedies, even though the sampling methodology and the results had been accepted by the regulatory agencies prior to and at the time of collection. In addition, Puls and Barcelona (1989) have recommended that if unfiltered values exceed the MCL for groundwater quality, additional analyses and re-evaluation of sampling artifacts should be performed.
- If the appropriate groundwater data had been collected and evaluated as part of USEPA's FS, USEPA would likely have determined that no groundwater remediation is necessary at the site.

3.3 GROUNDWATER REMEDIATION IS NOT NECESSARY

As part of the hydrogeologic investigation conducted by O'Brien and Gere during the RI, a well survey, which identified 36 wells within a 2-mile radius of the site, was conducted (O'Brien & Gere 1987). A list of these wells was included as Table 1 of the RI/FS Report. Based on the data presented in the RI, none of the wells identified was used for residential purposes. The majority of the wells identified were used for industrial/commercial supply or were relief wells associated with the Mississippi River Levee System.

In July 1989 the IEPA conducted a residential well survey to identify any private wells located hydraulically downgradient within 1 mile of the site and to further define well owners and uses for the 36 wells identified by O'Brien & Gere in the RI. As a result of this investigation, the IEPA identified two residential areas that may potentially contain private wells and determined that seven of the wells identified by O'Brien & Gere (Wells 4, 5, 6, 27, 28, 29) required further evaluation. Residential Area 1 was defined as the area north of Venice bounded by Meridocia, Salveter, Rogan, and College Streets and Residential Area 2 was identified as the area in Granite City bounded by State, Grand, 14th, and 15th Streets. The IEPA canvassed these areas to obtain further information regarding the existence and use of wells within the study area. During these canvassing efforts, no wells were identified as

being used for residential or consumptive purposes. Potable water is supplied by a local utility with the Mississippi River as its source.

Based on the well surveys conducted to date, there are no users of the groundwater downgradient of the area of the Main Industrial Property that has been proposed for groundwater remediation. Because there are no receptors of this groundwater, there is no exposure and consequently no risk associated with the groundwater. USEPA appears to agree with this position, as indicated by the comments made by Mr. Bradley (USEPA, project manager for the site) at a public meeting held March 6, 1995 (USEPA 1995b). Based on this information, there is no need to implement a groundwater remedy for the site. The risk will remain low after the cap is constructed because infiltration through the source area will be reduced.

3.4 PUMPING WILL NOT REMEDIATE METALS IN THE GROUNDWATER

Groundwater pumping would not be effective at reducing the metals concentrations in groundwater at the Granite City Site. The concentrations of lead and other metals detected in the samples collected by WWC are present only because these constituents adhere so strongly to the colloidal material in the monitoring wells. When extraction wells are installed at a site, well development procedures for these wells are designed to maximize well yield, with the ultimate result of providing sediment-free water at maximum specific capacity. It is important to have a sediment-free supply/extraction well because the presence of sediment in water supplies can be destructive to pumps and to water-discharge fittings (Driscoll 1986). Studies by Wendell, et al. (1992) have shown that metals concentration data for samples obtained from production wells most closely resembles filtered data from monitoring wells and that results of unfiltered samples from monitoring wells are not reflective of production well data (Wendell et al. 1992).

As discussed in Section 3.1.4, when properly analyzed, virtually all of the analytical results of the filtered and low flow samples collected from the site are below the MCLs and IGQSs for the constituents of concern. Therefore, if a recovery well system were designed for the site, the metals

concentrations detected in the recovery wells would be below the MCLs and IGQs. The supply wells installed for a groundwater pumping remedy would be designed to produce sediment free-water and consequently the lead and other metals detected in the monitoring well samples would remain in the sediments and be immobile and unrecoverable. In other words, the installation of pumping wells at the site would be ineffective because the groundwater pumped from these wells would be free of any suspended sediment.

3.5 CAPPING, COMBINED WITH NATURAL ATTENUATION AND MONITORING, IS AN EFFECTIVE REMEDY

Even if elevated levels of metals did exist in the groundwater at the site, which does not appear to be the case, the more appropriate remedy would be capping of the source area, natural attenuation of the metals concentration and monitoring. The cap would significantly reduce infiltration through the source area, thus reducing metals concentrations in the groundwater. Indeed, capping the pile at the Main Industrial Area is already a component of the proposed remedy. Geraghty & Miller's experience with this technology for metals indicates that large reductions in the concentrations of metals in groundwater often occur within a 10-year period. The effectiveness of this technology is likely to be virtually the same as pumping, but is less costly. In addition, capping combined with natural attenuation is easy to implement, virtually maintenance-free (except for maintaining the cap and performing the monitoring), and does not expose the local population to any undue risks.

4.0 CONCLUSIONS

Based on a review of the literature, data from previous investigations, a reinterpretation of the data, and the USEPA-recommended groundwater remedy, Geraghty & Miller has formed the following conclusions:

1. Because the groundwater data for the site are difficult to interpret, the USEPA appears to have selected only the most conservative data set (the analytical results of unfiltered samples). As a result, USEPA has overestimated the true metals concentrations in the groundwater at the site. Geraghty & Miller's review of the relevant literature and experience indicates that the most appropriate data are those samples that are filtered or have been collected with the new 'low flow' technique.
2. Geraghty & Miller's reinterpretation of the data, which excluded the unfiltered samples that did not use the low flow technique, indicates that the average metals concentrations are below MCLs (except for cadmium) and are below IGQSSs (except for cadmium and lead). The only reason that some average concentrations exceed the standards is because of the occurrence of high concentrations at a few wells, which skews the averages high. When these wells are excluded, the average cadmium concentrations are below MCLs and IGQSSs, and the average lead concentrations are below the MCLs and only 1.3 times the IGQSSs. Groundwater remediation is not warranted when the groundwater at the site meets the ARARs in all but a few wells and there is no groundwater exposure pathway.
3. Because the groundwater appears to meet almost all ARARs and there is no risk to human health from exposure to the groundwater since the groundwater in the area is not used for potable purposes, there is no need to remediate the groundwater.

4. Groundwater pumping would be ineffective at reducing the metals concentrations at the site. Because metals concentrations in the WWC samples are associated with high turbidity and recovery wells would be designed to exclude any sediment, the pumped water would contain, at most, low concentrations of metals. The vast majority of the metals would, therefore, remain bound to the sediment, immobile and unrecoverable.
5. Even if elevated levels of metals did exist in the groundwater at the site, a groundwater remedy based on capping the site source area to reduce infiltration, natural attenuation, and monitoring would be equally protective of human health and the environment and much less costly.

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Table 3-1. Monitoring Well Construction Details for Wells Associated with the Granite City Superfund Site Investigation, Granite City, Illinois.

Well No.	Installed By	Well Casing and Screen Diameter	Construction Material	Well Screen Length and Slot Size	Well Screen Gravel Pack	Well ^(a) Depth
MW-101	Taracorp	2-inch	PVC	5 ft slot size NA	W-B 40 sand	22
MW-102	Taracorp	2-inch	PVC	5 ft slot size NA	W-B 40 sand	22
MW-103	Taracorp	2-inch	PVC	5 ft slot size NA	W-B 40 sand	22
MW-104	Taracorp	2-inch	PVC	5 ft slot size NA	W-B 40 sand	22
MW-105S	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	Silica sand	26
MW-105D	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	In-situ sand	35.3
MW-106S	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	Silica sand	20.79
MW-106D	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	In-situ sand	34.91
MW-107S	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	Silica sand	22.46
MW-107D	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	In-situ sand	35.44
MW-108S	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	In-situ sand	20.4
MW-108D	IEPA	2-inch	Schedule 40 PVC	5 ft No.10 slot	In-situ sand	32.26
MW-109	OBG	2-inch	PVC	5 ft No.10 slot	Sand	34
MW-110	OBG	2-inch	PVC	5 ft No.10 slot	Sand	35
MW-103-91	WWC	2-inch	Type 304 SS	10 ft No.10 slot	Colorado silica sand 16-30	71
MW-104-92	WWC	2-inch	Type 304 SS	10 ft No.10 slot	Colorado silica sand 20/40	70
MW-106-92	WWC	2-inch	Type 304 SS	10 ft No.10 slot	Colorado silica sand 20/40	70
MW-111-92	WWC	2-inch	Type 304 SS	10 ft No.10 slot	NA	NA

(a) In feet below grade.
NA Information not available.
PVC Poly vinyl chloride.
IEPA Illinois Environmental Protection Agency.
OBG O'Brien & Gere Engineers, Inc.
WWC Woodward Clyde, Consultants.
SS Stainless steel.

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GERAGHTY & MILLER, INC.

Table 3-2. Summary of Previous Groundwater Monitoring Events Conducted by O'Brien & Gere Engineers, Inc. at the Granite City Superfund Site, Granite City, Illinois.

Well No.	Dates Sampled	Filtered Metals Collected	Unfiltered Metals Collected
MW-101	January 1987	Y	N
	April 1987	Y	N
	August 1987	Y	N
	November 1987	Y	N
MW-102	January 1987	Y	Y
	April 1987	Y	Y
MW-103	January 1987	Y	N
	April 1987	Y	N
MW-104	January 1987	Y	N
	April 1987	Y	N
MW-105S	January 1987	Y	N
MW-105D	January 1987	Y	N
	April 1987	Y	N
MW-106S	January 1987	Y	N
MW-106D	January 1987	Y	N
	April 1987	Y	Y
MW-107S	January 1987	Y	N
	April 1987	Y	N
MW-107D	January 1987	Y	N
	April 1987	Y	N
	August 1987	Y	N
	November 1987	Y	N
MW-108S	January 1987	Y	Y
MW-108D	January 1987	Y	N
	April 1987	Y	Y
	August 1987	Y	Y
	November 1987	Y	Y
MW-109	January 1987	Y	N
	April 1987	Y	N
	August 1987	Y	N
	November 1987	Y	N
MW-110	January 1987	Y	N
	April 1987	Y	N
	August 1987	Y	N
	November 1987	Y	N

Y Yes.
N No.



Table 2-3. Concentrations of Metals, Sulfate, and Total Dissolved Solids Detected in Groundwater Samples Collected from Monitoring Wells During the Remedial Investigation, Granite City Superfund Site, Granite City, Illinois.

Parameter	Well: MW-101 Date: Jan-87	MW-101 Apr-87	MW-101 Aug-87	MW-101 Nov-87	MW-102 Jan-87	MW-102 Apr-87	MW-103 Jan-87	MW-103 Apr-87	MW-104 Jan-87	MW-104 Apr-87
Antimony, filtered	<0.02	<0.02	NA	NA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic, filtered	0.077	0.070	0.101	0.071	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium, filtered	<1	<1	NA	NA	<1	<1	<1	<1	<1	<1
Cadmium, filtered	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001
Chromium, filtered	<0.005	<0.005	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper, filtered	<0.01	<0.01	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, filtered	20	20	22	22	0.12	<0.1	<0.10	<0.1	<0.10	<0.1
Lead, filtered	0.009	<0.005	<0.005	<0.005	0.013	<0.005	<0.005	<0.005	<0.005	<0.005
Lead, total	NA	NA	NA	NA	0.88	0.28	NA	NA	NA	NA
Manganese, filtered	4.3	4.22	4.9	5.5	0.27	0.124	0.06	<0.025	0.03	0.028
Mercury, filtered	<0.0005	<0.0005	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel, filtered	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium, filtered	<0.005	<0.002	NA	NA	<0.005	<0.002	<0.005	0.003	<0.005	0.003
Silver, filtered	<0.005	<0.005	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc, filtered	<0.02	<0.05	0.10	0.02	<0.02	<0.05	<0.02	<0.05	<0.02	<0.05
Sulfate	150	190	160	170	120	210	210	170	120	130
Total dissolved solids	590	530	650	690	640	610	500	550	360	400

All concentrations in milligrams per liter (mg/L).

NA Not analyzed.

Table 3-3. Concentrations of Metals, Sulfate, and Total Dissolved Solids Detected in Groundwater Samples Collected from Monitoring Wells During the Remedial Investigation, Granite City Superfund Site, Granite City, Illinois.

Parameter	Well: MW-105S Date: Jan-87	MW-105D Jan-87	MW-105D Apr-87	MW-106S Jan-87	MW-106D Jan-87	MW-106D Apr-87	MW-107S Jan-87	MW-107S Apr-87	MW-107D Jan-87	MW-107D Apr-87
Antimony, filtered	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic, filtered	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	0.011	0.014
Barium, filtered	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium, filtered	0.002	0.006	<0.001	0.013	0.008	0.002	0.001	<0.001	<0.001	<0.001
Chromium, filtered	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper, filtered	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Iron, filtered	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.1	7.7	8.1
Lead, filtered	<0.005	<0.005	<0.005	<0.005	0.011	0.013	<0.005	<0.005	<0.005	<0.005
Lead, total	NA	NA	NA	NA	0.50	0.72	NA	NA	NA	NA
Manganese, filtered	<0.025	0.19	0.284	0.08	0.09	0.359	0.07	0.139	0.43	0.422
Mercury, filtered	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel, filtered	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium, filtered	<0.005	<0.005	<0.002	<0.005	<0.005	0.003	<0.005	<0.002	<0.005	<0.002
Silver, filtered	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc, filtered	<0.02	0.03	<0.05	0.27	0.09	<0.05	<0.02	<0.05	NA	<0.05
Sulfate	320	140	180	290	160	260	260	300	540	550
Total dissolved solids	1000	660	620	1100	600	770	820	850	1370	1300

All concentrations in milligrams per liter (mg/L).

NA Not analyzed.

Table 3-3. Concentrations of Metals, Sulfate, and Total Dissolved Solids Detected in Groundwater Samples Collected from Monitoring Wells During the Remedial Investigation, Granite City Superfund Site, Granite City, Illinois.

Parameter	Well: MW-107D Date: Aug-87	MW-107D Nov-87	MW-108S Jan-87	MW-108D Jan-87	MW-108D Apr-87	MW-108D Aug-87	MW-108D Nov-87	MW-109 Aug-87	MW-109 Nov-87	MW-110 Aug-87
Antimony, filtered	NA	NA	<0.02	<0.02	<0.02	NA	NA	<0.02	<0.02	<0.02
Arsenic, filtered	<0.005	<0.005	<0.005	0.007	<0.005	0.007	<0.005	<0.005	<0.005	<0.005
Barium, filtered	NA	NA	<1	<1	<1	NA	NA	<1	<1	<1
Cadmium, filtered	<0.001	<0.001	0.209	3.3	5.2	6.9	<0.001	<0.001	<0.001	0.004
Copper, filtered	NA	NA	<0.01	<0.01	<0.01	NA	NA	0.01	<0.01	<0.01
Iron, filtered	8.8	5.8	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	0.4	<0.10
Lead, filtered	<0.005	<0.005	0.005	0.006	0.009	0.009	<0.005	<0.005	<0.005	<0.005
Lead, total	NA	NA	0.50	NA	0.22	NA	NA	0.007	<0.005	0.016
Manganese, filtered	0.40	0.37	13.1	18.1	29.4	25	29	0.11	0.28	1.0
Mercury, filtered	NA	NA	<0.0005	<0.0005	<0.0005	NA	NA	<0.0002	<0.0002	<0.0002
Nickel, filtered	<0.01	<0.01	0.20	0.50	0.70	0.94	0.81	<0.01	<0.01	0.02
Selenium, filtered	NA	NA	<0.005	<0.05	<0.002	NA	NA	<0.002	<0.002	<0.002
Silver, filtered	NA	NA	<0.005	<0.005	<0.005	NA	NA	<0.005	<0.005	<0.005
Zinc, filtered	<0.02	<0.02	0.04	37	44	44	44	<0.02	<0.02	0.02
Sulfate	490	480	1250	1560	1850	1800	1825	78	68	280
Total dissolved solids	1300	1232	3110	3860	4400	4800	4400	530	500	1000

All concentrations in milligrams per liter (mg/L).

NA Not analyzed.

Table 3-3. Concentrations of Metals, Sulfate, and Total Dissolved Solids Detected in Groundwater Samples Collected from Monitoring Wells During the Remedial Investigation, Granite City Superfund Site, Granite City, Illinois.

Well: MW-110	
Parameter	Date: May 97
Antimony, filtered	<0.02
Arsenic, filtered	<0.005
Berkum, filtered	<1
Cadmium, filtered	<0.001
Chromium, filtered	<0.005
Copper, filtered	<0.01
Iron, filtered	<0.10
Lead, filtered	<0.005
Lead, total	<0.005
Manganese, filtered	0.88
Mercury, filtered	<0.0002
Nickel, filtered	0.01
Selenium, filtered	<0.002
Silver, filtered	<0.005
Zinc, filtered	<0.02
Sulfate	294
Total dissolved solids	1000

All concentrations in milligrams per liter (mg/L).

NA Not analyzed.

Table 3-4. Average Concentrations of Metals in Groundwater at the Granite City Superfund Site, Granite City, Illinois.

Constituents	MCL (mg/L)	IGQS (mg/L)	Low Flow Rate Sampling Technique (1993-1994)		All Sampling Events		Low Flow Technique (Total Analyses) and All Filtered Results	
			Average (mg/L)	Number	Average (mg/L)	Number	Average (mg/L)	Number
Arsenic, total	0.05	0.05	0.0285	79	0.0696	120	0.0172	176
Arsenic, filtered			0	27	0.0083	97		
Cadmium, total	0.005	0.005	0.5086	79	0.6533	120	0.6362	176
Cadmium, filtered			0.9381	27	0.4433	97		
Chromium, total	0.1	0.1	0.0275	79	0.0465	120	0.0141	170
Chromium, filtered			0.0005	27	0.0002	91		
Lead, total	0.015	0.0075	0.0237	79	0.0902	130	0.0191	176
Lead, filtered			0.0001	27	0.0051	97		
Nickel, total	0.1	0.1	0.0587	79	0.0881	120	0.0798	176
Nickel, filtered			0.0659	27	0.0555	97		
Zinc, total	5.0	5.0	2.0362	79	2.4393	120	3.5303	175
Zinc, filtered			3.5259	27	2.8681	96		

MCL Maximum Contaminant Level (USEPA).
 IGQS Illinois Groundwater Quality Standard.
 Mg/L Milligrams per liter.

APPENDIX A

**SUMMARY OF GROUNDWATER DATA
COLLECTED BY WOODWARD-CLYDE CONSULTANTS**

Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-101						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Arsenic	mg/l	0.05	-	0.014 (1)	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006
Arsenic, filtered	mg/l	0.05	0.05	4.2 (3)	0.77 (3)	0.46 (3)	0.181 (1)	0.017	<0.006	<0.006
Beryllium	mg/l	0.004	-	0.0026	<0.0006	0.0006	<0.005	<0.010	<0.010	<0.010
Beryllium, filtered	mg/l	0.004	-	0.0019	0.0053 (3)	<0.005	0.006 (1)	<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	0.034	0.018 (1)	0.077	0.047	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.1	0.1	0.06	0.017	0.019	0.063	<0.010	<0.010	<0.010
Chromium	mg/l	1.3*	0.65	0.130 (3)	0.023 (3)	0.027 (3)	0.077 (1)	<0.025	<0.025	<0.025
Copper	mg/l	0.015*	0.0075	0.0002	<0.0002	<0.0002	<0.0002	<0.003	<0.003	<0.003
Copper, filtered	mg/l	0.015*	0.0075	0.13 (3)	0.027	0.077	0.072	<0.002	<0.002	<0.002
Lead	mg/l	0.002	0.002	0.1	<0.003	<0.003	0.007	<0.004	<0.004	<0.004
Lead, filtered	mg/l	0.002	0.002	0.1	<0.003	<0.003	0.007	<0.005	<0.005	<0.005
Mercury	mg/l	0.002	0.002	0.1	<0.004	<0.004	<0.010	<0.010	<0.010	<0.010
Mercury, filtered	mg/l	0.1	0.1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel	mg/l	0.1	0.1	0.1	0.009	0.009	<0.050	0.01	<0.010	<0.010
Nickel, filtered	mg/l	0.1	0.1	0.1	0.009	0.009	<0.050	0.01	<0.010	<0.010
Selenium	mg/l	0.05	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium, filtered	mg/l	0.05	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver, filtered	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Thallium	mg/l	0.002	-	0.35	0.098	0.11	0.199	<0.020	<0.020	<0.020
Thallium, filtered	mg/l	0.002	-	0.35	0.098	0.11	0.199	<0.020	<0.020	<0.020
Zinc	mg/l	-	5.0	0.35	0.098	0.11	0.199	<0.020	<0.020	<0.020
Zinc, filtered	mg/l	-	5.0	0.35	0.098	0.11	0.199	<0.020	<0.020	<0.020

Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-102			
				SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-		<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	0.015	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05		<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-		<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005		<0.005	<0.005	<0.005
Chromium	mg/l	0.1	0.1	0.027	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1		<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	0.028	<0.025	0.036	<0.025
Copper, filtered	mg/l	1.3*	0.65		<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.136 (3)	<0.003	<0.003	0.038 (3)
Lead, filtered	mg/l	0.015*	0.0075		<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002		<0.0002	<0.0002	<0.0002
Nickel	mg/l	0.1	0.1	0.062	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1		<0.040	<0.040	<0.040
Selenium	mg/l	0.05	0.05	0.015	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05		<0.005	<0.005	<0.005
Silver	mg/l	-	0.05	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05		<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-		<0.002	<0.002	<0.002
Zinc	mg/l	-	5.0	0.123	<0.020	0.031	0.028
Zinc, filtered	mg/l	-	5.0		<0.020	<0.020	<0.020

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-104						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	0.023 (1)	0.013 (1)	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-					<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	0.086 (3)	0.087 (3)	0.0046	0.018	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05					<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	0.0019	0.00322	<0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-					<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	0.0027	<0.005	<0.005	0.005 (3)	0.006 (3)	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005					<0.005	<0.005	<0.005
Chromium	mg/l	0.1	0.1	0.047	0.098 J	<0.013	0.035	<0.010	0.015	0.019
Chromium, filtered	mg/l	0.1	0.1					<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	0.064	0.097	<0.014	<0.025	<0.025	<0.025	<0.025
Copper, filtered	mg/l	1.3*	0.65					<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.47 (3)	0.42 (3)	0.013 (2)	0.043 (3)	0.019 (3)	0.032 (3)	0.091 (3)
Lead, filtered	mg/l	0.015*	0.0075					<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	0.0003	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002					<0.0002	<0.0002	<0.0002
Nickel	mg/l	0.1	0.1	0.12 (3)	0.19 (3)	<0.023	0.047	<0.040	<0.040	0.052
Nickel, filtered	mg/l	0.1	0.1					<0.040	<0.040	<0.040
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05					<0.005	<0.005	<0.005
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05					<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-					<0.002	<0.002	<0.002
Zinc	mg/l	-	5.0	0.24	0.38 J	<0.020	0.072	<0.020	0.040	0.050
Zinc, filtered	mg/l	-	5.0					<0.020	<0.020	<0.020

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-103-91					
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.002	0.014 (1)	<0.060	<0.050	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-						
Arsenic	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05						
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-						
Cadmium	mg/l	0.005	0.005	0.0017	<0.005	<0.005	<0.005	0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005						
Chromium	mg/l	0.1	0.1	<0.002	0.029 U	<0.013	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1						
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	<0.025
Copper, filtered	mg/l	1.3*	0.65						
Lead	mg/l	0.015*	0.0075	0.0027	0.0038	<0.002	<0.003	<0.003	<0.003
Lead, filtered	mg/l	0.015*	0.0075						
Mercury	mg/l	0.002	0.002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002						
Nickel	mg/l	0.1	0.1	<0.023	<0.023	<0.023	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1						
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05						
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	0.012	<0.010
Silver, filtered	mg/l	-	0.05						
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-						
Zinc	mg/l	-	5.0	0.036	0.074 J	<0.020	<0.020	<0.020	<0.020
Zinc, filtered	mg/l	-	5.0						

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-105S				MW-106S		
				SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994	SEPTEMBER 1993	APRIL 1994	JULY 1994
Antimony	mg/l	0.006	-	<0.050	<0.006	<0.006	<0.006	<0.050	0.008 (1)	<0.006
Antimony, filtered	mg/l	0.006	-		<0.006	<0.006			<0.006	<0.006
Arsenic	mg/l	0.05	0.05	<0.010	<0.010	<0.010	0.029	0.014	0.081 (3)	0.043
Arsenic, filtered	mg/l	0.05	0.05		<0.010	<0.010			<0.010	<0.010
Beryllium	mg/l	0.004	-	<0.005	<0.004	<0.004	<0.004	<0.005	0.007 (1)	0.004 (1)
Beryllium, filtered	mg/l	0.004	-		<0.004	<0.004			<0.004	<0.004
Cadmium	mg/l	0.005	0.005	<0.005	<0.005	<0.005	0.017 (3)	<0.005	0.005	0.004 (3)
Cadmium, filtered	mg/l	0.005	0.005		<0.005	<0.005			<0.005	<0.005
Chromium	mg/l	0.1	0.1	0.029	<0.010	0.026	0.118 (3)	0.476 (3)	0.183 (3)	0.137 (3)
Chromium, filtered	mg/l	0.1	0.1		<0.010	<0.010			<0.010	<0.010
Copper	mg/l	1.3*	0.65	<0.025	<0.025	<0.025	0.055	0.056	0.179	0.16
Copper, filtered	mg/l	1.3*	0.65		<0.025	<0.025			<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.015 (3)	0.008 (2)	0.035 (3)	0.149 (3)	0.143 (3)	0.776 (3)	0.269 (3)
Lead, filtered	mg/l	0.015*	0.0075		<0.003	<0.003			<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0006 (3)	0.0003
Mercury, filtered	mg/l	0.002	0.002		<0.0002	<0.0002			<0.0002	<0.0002
Nickel	mg/l	0.1	0.1	<0.040	<0.040	<0.040	0.122 (3)	0.366 (3)	0.22 (3)	0.208 (3)
Nickel, filtered	mg/l	0.1	0.1		<0.040	<0.040			<0.040	<0.040
Selenium	mg/l	0.05	0.05	0.016	0.011	<0.005	<0.005	0.011	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05		0.014	<0.005			<0.005	<0.005
Silver	mg/l	-	0.05	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05		<0.010	<0.010			<0.010	<0.010
Thallium	mg/l	0.002	-	<0.050	<0.002	<0.002	<0.002	<0.050	0.003 (1)	0.003 (1)
Thallium, filtered	mg/l	0.002	-		<0.002	<0.002			<0.002	<0.002
Zinc	mg/l	-	5.0	0.039	<0.020	0.045	0.360	0.181	0.876	0.671
Zinc, filtered	mg/l	-	5.0		<0.020	<0.020			<0.020	0.023

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-104-92						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	0.007 (1)	0.01 (1)	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-					<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	0.0088	0.0032	<0.003	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05					<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-					<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	0.0033	<0.005	<0.005	0.005 (3)	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005					<0.005	<0.005	<0.005
Chromium	mg/l	0.1	0.1	0.002	0.034 J	<0.013	<0.010	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1					<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	<0.025	0.047
Copper, filtered	mg/l	1.3*	0.65					<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.44 (3)	0.27 (3)	0.043 (3)	0.520/0.480 (3)	0.036 (3)	0.054 (3)	0.090 (3)
Lead, filtered	mg/l	0.015*	0.0075					<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002					<0.0002	<0.0002	<0.0002
Nickel	mg/l	0.1	0.1	<0.023	<0.023	<0.023	<0.040	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1					<0.040	<0.040	<0.040
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05					<0.005	<0.005	<0.005
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05					<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-					<0.002	<0.002	<0.002
Zinc	mg/l	-	5.0	0.082	0.066 J	<0.020	0.037	<0.020	0.020	<0.020
Zinc, filtered	mg/l	-	5.0					<0.020	<0.020	<0.020

**Table 1 - 5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-107S						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	0.008 (1)	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-					<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	0.044	0.10 (3)	0.026	<0.010	<0.010	0.032	0.093 (3)
Arsenic, filtered	mg/l	0.05	0.05					<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	0.002	0.0079 (1)	0.0019	<0.005	<0.004	<0.004	0.006 (1)
Beryllium, filtered	mg/l	0.004	-					<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	0.0032	0.010 (3)	<0.005	<0.005	<0.005	0.006 (3)	0.029 (3)
Cadmium, filtered	mg/l	0.005	0.005					<0.005	<0.005	<0.005
Chromium	mg/l	0.1	0.1	0.042	0.35 (3)	0.061	0.014	0.017	0.270 (3)	0.142 (3)
Chromium, filtered	mg/l	0.1	0.1					<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	0.064	0.3	0.066	<0.025	<0.025	0.116	0.222
Copper, filtered	mg/l	1.3*	0.65					<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.14 (3)	0.52 (3)	0.087 (3)	0.047 (3)	0.007	0.077 (3)	0.176 (3)
Lead, filtered	mg/l	0.015*	0.0075					<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	0.0006	<0.0002	<0.0002	<0.0002	0.0018	0.0004
Mercury, filtered	mg/l	0.002	0.002					<0.0002	0.0015	<0.0002
Nickel	mg/l	0.1	0.1	0.11 (3)	0.43 (3)	0.092	<0.040	<0.040	0.257 (3)	0.280 (3)
Nickel, filtered	mg/l	0.1	0.1					<0.040	<0.040	<0.040
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	0.011	<0.005	<0.005	0.010
Selenium, filtered	mg/l	0.05	0.05					<0.005	0.006	<0.005
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05					<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-					<0.002	<0.002	0.003 (1)
Zinc	mg/l	-	5.0	0.25	0.86	0.18	0.084	0.041	0.282	0.59
Zinc, filtered	mg/l	-	5.0					<0.020	<0.020	<0.020

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-106D						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	0.003	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-					<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	0.013	0.0032	<0.003	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05					<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-					<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	0.0005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005					<0.005	<0.005	<0.005
Chromium	mg/l	0.1	0.1	<0.002	0.015 U	<0.013	0.019	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1					<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	0.063	<0.025
Copper, filtered	mg/l	1.3*	0.65					<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.019 (3)	0.019 (3)	<0.002	<0.003	<0.003	0.012 (2)	<0.003
Lead, filtered	mg/l	0.015*	0.0075					<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002					<0.0002	<0.0002	<0.0002
Nickel	mg/l	0.1	0.1	<0.023	0.026	<0.023	<0.040	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1					<0.040	<0.040	<0.040
Selenium	mg/l	0.05	0.05	0.0077	0.01	0.0098	0.013	0.005 J	0.008	0.006
Selenium, filtered	mg/l	0.05	0.05					0.006	0.008	0.006
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05					<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-					<0.002	<0.002	<0.002
Zinc	mg/l	-	5.0	<0.020	0.067	<0.020	<0.020	0.026	0.041	<0.020
Zinc, filtered	mg/l	-	5.0					<0.020	<0.020	<0.020

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-107D QC FIELD DUPLICATE		
				APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-	<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05	<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-	<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	<0.005	<0.005	0.006(3)
Cadmium, filtered	mg/l	0.005	0.005	<0.005	<0.005	<0.005
Chromium	mg/l	0.1	0.1	<0.010	0.158(3)	0.062
Chromium, filtered	mg/l	0.1	0.1	<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	<0.025	<0.025	0.253
Copper, filtered	mg/l	1.3*	0.65	<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	<0.003	0.006	0.093(3)
Lead, filtered	mg/l	0.015*	0.0075	<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	0.0012	<0.0002
Mercury, filtered	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002
Nickel	mg/l	0.1	0.1	<0.040	0.116(3)	0.067
Nickel, filtered	mg/l	0.1	0.1	<0.040	<0.040	<0.040
Selenium	mg/l	0.05	0.05	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05	<0.005	<0.005	<0.005
Silver	mg/l	-	0.05	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05	<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-	<0.002	<0.002	<0.002
Zinc	mg/l	-	5.0	<0.020	0.032	0.189
Zinc, filtered	mg/l	-	5.0	<0.020	<0.020	<0.020

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-107D						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	0.005	<0.011	<0.060	<0.050	<0.006	<0.006 UJ	<0.006
Antimony, filtered	mg/l	0.006	-					<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	0.065 (3)	0.04	0.024	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05					<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	0.0016	0.0017	0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-					<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	0.0018	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005					<0.005	<0.005	<0.005
Chromium	mg/l	0.1	0.1	0.044	0.067 J	0.078	0.076	<0.010	0.118 (3)	0.113 (3)
Chromium, filtered	mg/l	0.1	0.1					<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	0.052	0.054	0.027	<0.025	<0.025	<0.025	0.100
Copper, filtered	mg/l	1.3*	0.65					<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.11 (3)	0.12 (3)	0.067 (3)	<0.003	<0.003	0.006	0.015 (2)
Lead, filtered	mg/l	0.015*	0.0075					<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	0.0010 J	<0.0002
Mercury, filtered	mg/l	0.002	0.002					<0.0002	0.0006	<0.0002
Nickel	mg/l	0.1	0.1	0.054	0.057	0.045	<0.040	<0.040	0.092	0.086
Nickel, filtered	mg/l	0.1	0.1					<0.040	<0.040	<0.040
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005 UJ	<0.005
Selenium, filtered	mg/l	0.05	0.05					<0.005	<0.005	<0.005
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010 UJ
Silver, filtered	mg/l	-	0.05					<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-					<0.002	<0.002	<0.002
Zinc	mg/l	-	5.0	0.22	0.25	0.091	0.05	<0.020	0.042	0.054
Zinc, filtered	mg/l	-	5.0					<0.020	<0.020	<0.020

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-108D						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.008	0.022 (1)	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-					<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	<0.003	0.018	<0.003	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05					<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	<0.0006	0.00202	<0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-					<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	8.5 (3)	9.6 (3)	1.9 (3)	4.51 (3)	5.41 (3)	10.3 (3)	11.6 (3)
Cadmium, filtered	mg/l	0.005	0.005					5.08 (3)	9.45 (3)	10.8 (3)
Chromium	mg/l	0.1	0.1	0.006	0.073 (1)	0.022	<0.010	<0.010	0.110 (3)	<0.010
Chromium, filtered	mg/l	0.1	0.1					<0.010	0.014	<0.010
Copper	mg/l	1.3*	0.65	<0.014	0.045	<0.014	<0.025	<0.025	0.053	<0.025
Copper, filtered	mg/l	1.3*	0.65					<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	0.023 (3)	0.14 (3)	0.0043	<0.003	<0.003	0.102 (3)	0.0017
Lead, filtered	mg/l	0.015*	0.0075					<0.003	0.004	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	0.0009	<0.0002
Mercury, filtered	mg/l	0.002	0.002					<0.0002	0.0012	<0.0002
Nickel	mg/l	0.1	0.1	0.46 (3)	0.63 (3)	0.17 (3)	0.313 (3)	0.435 (3)	0.793 (3)	0.849 (3)
Nickel, filtered	mg/l	0.1	0.1					0.396 (3)	0.564 (3)	0.818 (3)
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.015	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05					<0.005	<0.005	<0.005
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	0.012	<0.010	<0.010
Silver, filtered	mg/l	-	0.05					<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	0.046 (1)	0.046 (1)	0.028 (1)	<0.050	0.045 (1)	0.094 (1)	0.133 (1)
Thallium, filtered	mg/l	0.002	-					0.043 (1)	0.101 (1)	0.136 (1)
Zinc	mg/l	-	5.0	28 (2)	34 (2)	7.6 (2)	18.1 (2)	23.1 (2)	38.6 (2)	44.9 (2)
Zinc, filtered	mg/l	-	5.0					21.5 (2)	31.3 (2)	42.4 (2)

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-108S			
				SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.050	0.007 (1)	<0.006	0.010 (1)
Antimony, filtered	mg/l	0.006	-		<0.006	<0.006	<0.006
Arsenic	mg/l	0.05	0.05	0.109 (3)	0.017	0.025	0.091 (3)
Arsenic, filtered	mg/l	0.05	0.05		<0.010	<0.010	<0.010
Beryllium	mg/l	0.004	-	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-		<0.004	<0.004	<0.004
Cadmium	mg/l	0.005	0.005	0.475 (3)	0.180 (3)	0.225 (3)	0.963 (3)
Cadmium, filtered	mg/l	0.005	0.005		0.144 (3)	0.123 (3)	0.368 (3)
Chromium	mg/l	0.1	0.1	0.082	0.043	1.35 (3)	0.318 (3)
Chromium, filtered	mg/l	0.1	0.1		<0.010	<0.010	<0.010
Copper	mg/l	1.3*	0.65	0.092	0.039	0.140	0.108
Copper, filtered	mg/l	1.3*	0.65		<0.025	<0.025	<0.025
Lead	mg/l	0.015*	0.0075	1.02 (3)	0.312 (3)	0.246 (3)	1.17 (3)
Lead, filtered	mg/l	0.015*	0.0075		<0.003	<0.003	<0.003
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	0.0015	0.0003
Mercury, filtered	mg/l	0.002	0.002		<0.0002	0.0005	<0.0002
Nickel	mg/l	0.1	0.1	0.254 (3)	0.075	0.980 (3)	0.492 (3)
Nickel, filtered	mg/l	0.1	0.1		<0.040	0.083	0.073
Selenium	mg/l	0.05	0.05	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05		<0.005	<0.005	<0.005
Silver	mg/l	-	0.05	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05		<0.010	<0.010	<0.010
Thallium	mg/l	0.002	-	0.07 (1)	0.008 (1)	0.011 (1)	0.014 (1)
Thallium, filtered	mg/l	0.002	-		0.003 (1)	0.005 (1)	0.003 (1)
Zinc	mg/l	-	5.0	0.567	0.177	0.376	0.759
Zinc, filtered	mg/l	-	5.0		0.028	0.151	0.159

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-109						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.002	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-							
Arsenic	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05							
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-							
Cadmium	mg/l	0.005	0.005	0.0028	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005							
Chromium	mg/l	0.1	0.1	<0.002	<0.013	<0.013	<0.010	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1							
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	<0.025	0.027
Copper, filtered	mg/l	1.3*	0.65							
Lead	mg/l	0.015*	0.0075	0.0046	0.019 (3)	<0.002	<0.003	<0.003	<0.003	<0.003
Lead, filtered	mg/l	0.015*	0.0075							
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002							
Nickel	mg/l	0.1	0.1	<0.023	<0.023	<0.023	0.059	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1							
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05							
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05							
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-							
Zinc	mg/l	-	5.0	0.057	0.077 J	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc, filtered	mg/l	-	5.0							

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-108D QC FIELD DUPLICATE			
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993
Antimony	mg/l	0.006	-	<0.002	<0.011	<0.060	<0.050
Antimony, filtered	mg/l	0.006	-				
Arsenic	mg/l	0.05	0.05	<0.003	0.023	<0.003	<0.010
Arsenic, filtered	mg/l	0.05	0.05				
Beryllium	mg/l	0.004	-	0.0007	0.00188	<0.0006	<0.005
Beryllium, filtered	mg/l	0.004	-				
Cadmium	mg/l	0.005	0.005	9.0 (3)	9.2 (3)	1.9 (3)	4.42 (3)
Cadmium, filtered	mg/l	0.005	0.005				
Chromium	mg/l	0.1	0.1	0.006	0.084 J	0.029	<0.010
Chromium, filtered	mg/l	0.1	0.1				
Copper	mg/l	1.3*	0.65	<0.014	0.044	<0.014	<0.025
Copper, filtered	mg/l	1.3*	0.65				
Lead	mg/l	0.015*	0.0075	0.026 (3)	0.15 (3)	0.0038	<0.003
Lead, filtered	mg/l	0.015*	0.0075				
Mercury	mg/l	0.002	0.002	<0.0002	0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002				
Nickel	mg/l	0.1	0.1	0.47 (3)	0.64 (3)	0.18 (3)	0.302 (3)
Nickel, filtered	mg/l	0.1	0.1				
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.015	<0.005
Selenium, filtered	mg/l	0.05	0.05				
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010
Silver, filtered	mg/l	-	0.05				
Thallium	mg/l	0.002	-	0.048 (1)	0.051 (1)	0.029 (1)	0.05 (1)
Thallium, filtered	mg/l	0.002	-				
Zinc	mg/l	-	5.0	28 (2)	34 (2)	7.7 (2)	17.9 (2)
Zinc, filtered	mg/l	-	5.0				

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-110							MW-110 QC FIELD DUPLICATION
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994	JULY 1994
Antimony	mg/l	0.006	-	<0.002	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-								
Arsenic	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05								
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-								
Cadmium	mg/l	0.005	0.005	0.0013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005								
Chromium	mg/l	0.1	0.1	<0.002	<0.013	<0.013	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1								
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	0.043	0.064	0.070
Copper, filtered	mg/l	1.3*	0.65								
Lead	mg/l	0.015*	0.0075	0.0042	0.017 (3)	<0.002	<0.003	<0.003	<0.003	<0.003	<0.003
Lead, filtered	mg/l	0.015*	0.0075								
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002								
Nickel	mg/l	0.1	0.1	<0.023	0.033	<0.023	<0.040	<0.040	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1								
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05								
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05								
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-								
Zinc	mg/l	-	5.0	0.043	0.078	<0.020	<0.020	<0.020	0.092	0.051	0.081
Zinc, filtered	mg/l	-	5.0								

Woodward-Clyde

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-109-92						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.005	-	<0.002	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.005	-							
Arsenic	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05							
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-							
Cadmium	mg/l	0.005	0.005	0.0018	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005							
Chromium	mg/l	0.1	0.1	0.003	0.021 U	<0.013	<0.010	0.011	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1							
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	<0.025	0.154
Copper, filtered	mg/l	1.3*	0.65							
Lead	mg/l	0.015*	0.0075	0.018 (3)	0.0038	<0.002	<0.003	<0.003	<0.003	<0.003
Lead, filtered	mg/l	0.015*	0.0075							
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002							
Nickel	mg/l	0.1	0.1	<0.023	<0.023	<0.023	<0.040	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1							
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05							
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05							
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-							
Zinc	mg/l	-	5.0	0.081	0.057 J	<0.020	<0.020	<0.020	<0.020	0.009
Zinc, filtered	mg/l	-	5.0							

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-111-92 QC FIELD DUPLICATE					
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.002	<0.011	<0.060	<0.050	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-						
Arsenic	mg/l	0.05	0.05	0.004	<0.003	<0.003	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05						
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-						
Cadmium	mg/l	0.005	0.005	0.0004	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005						
Chromium	mg/l	0.1	0.1	<0.002	0.027 U	<0.013	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1						
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	<0.025
Copper, filtered	mg/l	1.3*	0.65						
Lead	mg/l	0.015*	0.0075	0.0094 (2)	0.0072	<0.002	<0.003	<0.003	<0.003
Lead, filtered	mg/l	0.015*	0.0075						
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002						
Nickel	mg/l	0.1	0.1	<0.023	<0.023	<0.023	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1						
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05						
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05						
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-						
Zinc	mg/l	-	5.0	0.059	0.068	<0.020	<0.020	<0.020	<0.020
Zinc, filtered	mg/l	-	5.0						

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-111-92						
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994
Antimony	mg/l	0.006	-	<0.002	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-							
Arsenic	mg/l	0.05	0.05	0.0046	0.0037	<0.003	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05							
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-							
Cadmium	mg/l	0.005	0.005	<0.0003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005							
Chromium	mg/l	0.1	0.1	<0.002	0.024 U	<0.013	<0.010	<0.010	0.015	<0.010
Chromium, filtered	mg/l	0.1	0.1							
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	0.029	<0.025
Copper, filtered	mg/l	1.3*	0.65							
Lead	mg/l	0.015*	0.0075	0.003	0.009 (2)	<0.002	<0.003	<0.003	<0.003 UJ	<0.003
Lead, filtered	mg/l	0.015*	0.0075							
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002							
Nickel	mg/l	0.1	0.1	<0.023	<0.023	<0.023	<0.040	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1							
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005 UJ	<0.005
Selenium, filtered	mg/l	0.05	0.05							
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05							
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	<0.002
Thallium, filtered	mg/l	0.002	-							
Zinc	mg/l	-	5.0	0.043	0.073	<0.020	<0.020	<0.020	0.088	<0.020
Zinc, filtered	mg/l	-	5.0							

**Table 1 – 5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Notes:

- U – The compound was analyzed for but was not detected. The associated numerical value is attributed to contamination and is considered to be the sample quantitation limit.**
- J – The associated numerical value is an estimated quantity.**
- * – Action Level that triggers treatment.**
- (1) – Sample concentration is above the MCL.**
- (2) – Sample concentration is above the Illinois Groundwater Quality Standard for a Class I Potable Resource.**
- (3) – Sample Concentration is above both the MCL and the Illinois Class I Groundwater Quality Standard
Illinois Class I Groundwater Quality Standard.**

**Table 1-5: Metals Results of
Historical Groundwater Sampling Events
NL/Taracorp Superfund Site**

Parameter	Unit	MCLs (mg/L)	ILLINOIS CLASS I STANDARDS (mg/L)	MW-112 QC RINSATE BLANK							MW-113 QC RINSATE APRIL 1994
				JULY 1992	OCTOBER 1992	MARCH 1993	SEPTEMBER 1993	APRIL 1994	JULY 1994	OCTOBER 1994	
Antimony	mg/l	0.006	-	<0.002	<0.011	<0.060	<0.050	<0.006	<0.006	<0.006	<0.006
Antimony, filtered	mg/l	0.006	-								
Arsenic	mg/l	0.05	0.05	0.0032	<0.003	<0.003	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic, filtered	mg/l	0.05	0.05								
Beryllium	mg/l	0.004	-	<0.0006	<0.0006	<0.0006	<0.005	<0.004	<0.004	<0.004	<0.004
Beryllium, filtered	mg/l	0.004	-								
Cadmium	mg/l	0.005	0.005	<0.0003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, filtered	mg/l	0.005	0.005								
Chromium	mg/l	0.1	0.1	<0.002	<0.013	<0.013	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium, filtered	mg/l	0.1	0.1								
Copper	mg/l	1.3*	0.65	<0.014	<0.014	<0.014	<0.025	<0.025	<0.025	<0.025	<0.025
Copper, filtered	mg/l	1.3*	0.65								
Lead	mg/l	0.015*	0.0075	<0.002	<0.002	<0.002	<0.003	<0.003	<0.003	<0.003	<0.003
Lead, filtered	mg/l	0.015*	0.0075								
Mercury	mg/l	0.002	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Mercury, filtered	mg/l	0.002	0.002								
Nickel	mg/l	0.1	0.1	<0.023	<0.023	<0.023	<0.040	<0.040	<0.040	<0.040	<0.040
Nickel, filtered	mg/l	0.1	0.1								
Selenium	mg/l	0.05	0.05	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005
Selenium, filtered	mg/l	0.05	0.05								
Silver	mg/l	-	0.05	<0.0004	<0.009	<0.009	<0.010	<0.010	<0.010	<0.010	<0.010
Silver, filtered	mg/l	-	0.05								
Thallium	mg/l	0.002	-	<0.002	<0.002	<0.002	<0.050	<0.002	<0.002	0.003(1)	<0.002
Thallium, filtered	mg/l	0.002	-								
Zinc	mg/l	-	5.0	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc, filtered	mg/l	-	5.0								